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Entomology

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disease caused by *B. Malvacearum*, an investigation hitherto financed by the Empire Marketing Board. Miss Glynne has continued her work on Wart Disease of Potatoes and on Take-all (*Ophiobolus graminis*, Sacc) on wheat. The Wart Disease investigation is widened so as to include a study of some of the new varieties under examination at Ormskirk, a special grant being given by the Ministry of Agriculture for this purpose. A rapid method devised by Miss Glynne is used for distinguishing immune from susceptible varieties. This method, which needs only a few weeks for execution, gives results which agree in general with those obtained in the field after some two or three years trials; it is therefore a great convenience to the potato breeder, because it shows him at once what material to discard and what to preserve. Miss Glynne finds an intermediate group of potato varieties which can be attacked by the disease organism, but which have the power of sloughing it off, so that it does no damage to the crop and causes no apparent loss in the field.

Miss Glynne also continued her survey of fungus diseases on the experimental plots, which is giving a mass of valuable observational data.

Thanks to action on the part of the Ministry of Agriculture, it has been possible to continue in full the investigations on Virus Diseases of Plants, hitherto financed by the Empire Marketing Board. No striking advance can be reported this year, but there has been a good deal of general progress as the result of much quiet steady work. In spite of many attempts, no method has yet been found of growing the virus outside the plant. The analysis of virus diseases has continued. A fourth "ring spot" disease of tobacco has been found, caused by a mixture of two separate viruses, neither of which alone can produce it. The aucuba virus of tomato, which has been in our laboratory for some time, is now shown to be a mixture of two which act differently and apparently are to some extent mutually inhibitory. The production of virus symptoms by a trace of molybdic acid and perhaps of other chemicals has been further followed up, as also has the part played by the insect that carries the virus from one plant to another.

A beginning has been made by J. M. Birkeland on the application to plant viruses of the serological methods so much used in animal pathology.

ENTOMOLOGY

The chief investigations in this Department are concerned with:

- (1) The factors responsible for the variations in numbers of insect populations;
- (2) The causes of the attraction of insects to the plant that they attack;
- (3) Methods by which they can be kept in check.

In studying the variations in numbers of insects from time to time, C. B. Williams has arranged some ingenious lighted traps to take samples of the night flying insect population. The catches for each separate hour of the night are kept distinct, and records are taken showing the meteorological conditions throughout the night, including continuous records of rainfall, temperature, pressure, wind direction and velocity, humidity, cloudiness, and degree of brightness. Data are being amassed, but it is too early to discuss them as yet.

H. F. Barnes showed that the infestation of wheat by the two blossom midges *C. tritici* and *S. mosellana* was much less than last year (0.6 and 1.4 per cent. kernel attack respectively against 5 and 10.5 per cent. in 1932), probably because of the earlier emergence of the midges which prevented them ovipositing on the wheat.

Some of H. F. Barnes' observations on wheat midges are summarised in Table 8.

TABLE 8.—Damage to Wheat by Wheat Midges : Broadbalk.

(a) By <i>Contarinia tritici</i> Kirby.							
Per 500 ears wheat.	1927	1928	1929	1930	1931	1932	1933
No. of larvae ..	1,780	2,195	19,265	18,595	19,273	7,356	1,511
No. of lost grain ..	239	203	1,434	1,394	1,701	1,039	125
Percentage of grain attacked ..	0.95	0.79	5.9	5.9	6.4	4.9	0.65
Degree of Parasitism		1928-9	1929-30	1930-1	1931-2	1932-3	
		9.5%	27%	53%	45%	73%	
(b) By <i>Sitodiplosis mosellana</i> , Géhin.							
Per 500 ears wheat.	1927	1928	1929	1930	1931	1932	1933
No. of larvae ..	715	2,043	587	3,746	6,027	3,114	319
No. of lost grain ..	541	1,486	434	2,760	4,032	2,260	273
Percentage of grain attacked ..	2.2	5.7	1.8	11.7	15.0	10.5	1.4
Degree of Parasitism		1928-9	1929-30	1930-1	1931-2	1932-3	
		73%	43%	85%	85%	85%	

The degree of parasitism of the gall midge ("button top" galls) on basket willows was much less than in 1932, being about 13 per cent., instead of 53 per cent., and the number of midges was considerably higher. The total number of midges and parasites obtained from the plants, however, showed no marked change.

Population of 500 galls of the midge *Rhabdophaga heterobia*.

Year.	Midges.	Parasites.	Midges and Parasites.	Percentage Parasitism.
1932 ..	1,480	1,662	3,142	53
1933 ..	2,810	428	3,239	13

H. C. F. Newton is studying the phenomena of oviposition by this insect on different willow species. The purpose is to find why the insect chooses certain species on which to lay its eggs; why it avoids others, and whether the species preferred can be made distasteful. The phenomena of gall formation are also being studied. It appears that willows can be divided into three groups: those on which eggs are laid and galls formed; those on which eggs are laid but no galls formed; and those on which no eggs are laid.

A sawfly (*Pteronidea melanaspis*) behaves towards the different willow species in just the opposite way to the midge. This suggests that a chemical constituent of the leaf is concerned, and it is repellent to the one insect but attractive to the other. This work is being closely followed up.

A nematode parasite of a grass thrips (*Aptinothrips rufus*) is being studied by Miss Lysaght, and also an internal fungus disease of the same thrips; so far the fungus has not been identified.